# AN OVERVIEW OF THE LAND ANALYSIS SYSTEM (LAS)

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# LAND ANALYSIS SYSTEM

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Code 636

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# AGENDA

- History
- Development Methodology
- Major Hardware and Software Components
- Hardware Configuration
- Independent Audit--Evaluation Criteria and Approach
- Desired Enhancements
- Configuration Control Board
- Dissemination of LAS

## HISTORY

- Lansat-D Assessment System--1980
- Landsat-D Assessment System--1981
- Land Analysis System (LAS)--August 1983
- Independent Audit Started--Feburary 1984
- Outside User Contribution (EROS Data Center)--June 1984
- LAS Configuration Control Board--June 1985
- LAS Version 3.1 Release--August 1985
- LAS Available Through COSMIC--July 1986

## REQUIREMENTS

- User Interface (TAE)
- Functional Capabilities
- System Support Services
- Documentation
- System Performance

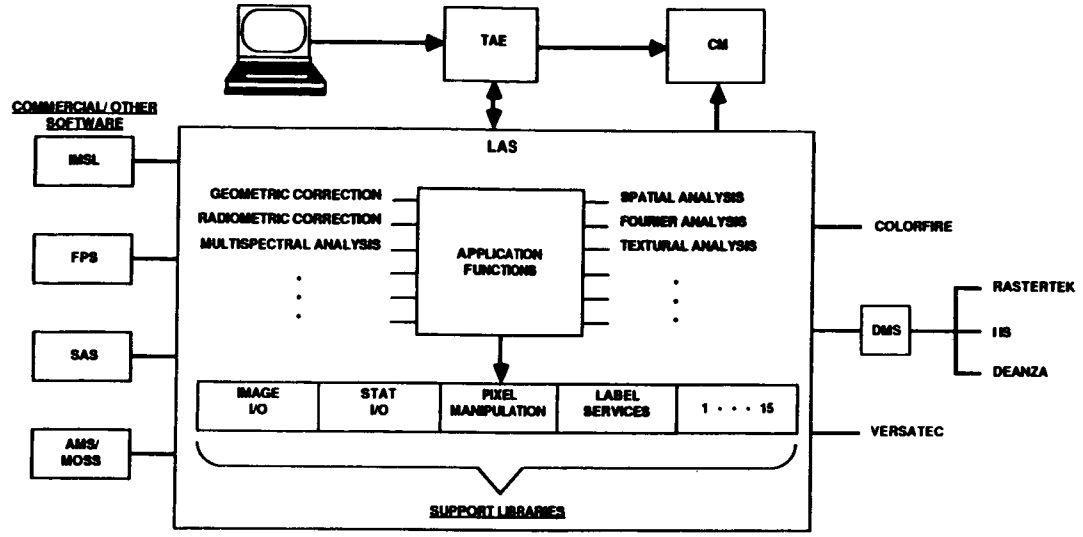
## DEVELOPMENT METHODOLOGY

- Define Requirements
- Design and Review
- Implementation
- Unit Testing
- Integration and System Testing
- Acceptance Testing
- Configuration Control
- Independent Auditing

## DESIGN ELEMENTS

- Batch and Interactive Processing
- Flexible User-System Interface
- Extensive Session History
- Automatic Cataloging of Data Sets
- Menu and Command Mode Processing
- Multi-level Help File for All Processing Functions

# THE LAND ANALYSIS SYSTEM




CM = CATALOG MANAGER
DMS = DISPLAY MANAGEMENT SUB-SYSTEM
TAE = TRANSPORTABLE APPLICATIONS EXECUTIVE

# SYSTEM SUPPORT SERVICES

- Transportable Applications Executive (TAE)
  - User Friendly Interface
  - Online Help
- Catalog Manager
  - Meaningful Names for Images and Data Files
  - Archival and Retrieval Functions
- History Files
  - Complete Processing History Information for all Images
- Applications Services
  - Assembly Language Codes to Help Programmers (Image I/O, Statistics I/O, and Pixel Manipulation
- Session Logging
- Ancillary Data Processing
  - TM HAAT Files
  - Statistics
  - Image Registration Points

LAS HARDWARE SYSTEM SUMMARY

VAX-11/780 ---> CLUSTER

8 MBYTES MEMORY

AP180V ARRAY PROCESSOR

8 RP06 MOUNTABLE DISKS (@176 MBYTES)

3 RA81 FIXED DISKS (@450 MBYTES)

3 (2) 6250 BPI TAPE DRIVES

3 (2) HAZELTINE IMAGE TERMINALS

2 IIS MODEL 75 IMAGE TERMINALS

FILM RECORDERS

- DICOMED
- OPTRONICS L5500 B&W
- MATRIX CAMERA
- COLORFIRE 240

LAS
Land Analysis System

# USER INTERFACE

- **The LAS is integrated under the Transportable Applications Executive (TAE).**
  - **Human Engineered User Interface**
  - **Extensive On-Line Multi-Level Help Files**
  - **Menu and Command Mode Processing**
  - **Tutoring Capability**
  - **Parameter Save File**
  - **Programmer Interface**

# FUNCTIONAL CAPABILITIES

- A total of 224 applications programs were developed in response to users' requirements.
  - Arithmetic and Logical Functions
  - Data Transfer Functions
  - File Management Functions
  - Fourier and Complex Image Functions
  - Geometric Transformation Functions
  - Hard Copy and Terminal Listing Functions
  - Image Restoration
  - Intensity Transformation Functions
  - Multispectral Processing Functions
  - Spatial Processing Functions
  - Statistics and Sampling Functions
  - Miscellaneous Functions

```
Menu:   "ROOT", library "TAE$MENU"

        ************************************************************
        *                                                          *
        *         LAND  ANALYSIS  SYSTEM  -  Version 3.1B          *
        *                                                          *
        *                        AUGUST, 1985                      *
        ************************************************************

1)  System I/O Functions Menu
2)  Applications Functions Menu
3)  Image Display Functions Menu
4)  Utility Functions Menu
5)  Catalog Manager Functions Menu
6)  TAE Session Log Functions Menu
7)  General Information menu



Enter:  selection number, HELP, BACK, TOP, MENU, COMMAND, or LOGOFF.
```

```
Menu:   "APPLIC", library "LAS $MENU:"

1)  Arithmetic Functions Menu

2)  Classification Functions Menu

3)  Fourier Transform Functions Menu

4)  Geometric Rectification Functions Menu

5)  Logical Functions Menu

6)  Radiometric Correction Functions Menu

7)  Sampling Functions Menu

8)  Spatial Functions Menu

9)  Applications Utility Functions Menu


Enter:  selection number, HELP, BACK, TOP, MENU, COMMAND, or LOGOFF.
```

```
Menu:   "CLASS", library "LAS $MENU:"

              **********************************
              *  CLASSIFICATION FUNCTIONS      *
              **********************************

1)  Supervised Classification Functions
2)  Unsupervised Classification Functions
3)  Classification Utility Functions









Enter:  selection number, HELP, BACK, TOP, MENU, COMMAND, or LOGOFF.
```

```
Menu:   "UNSUPER", library "LAS $MENU:"

          ******************************************
          *  UNSUPERVISED CLASSIFICATION FUNCTIONS  *
          ******************************************

1)  Linear Discriminant Analysis                      (DISCRIM)
2)  Clustering via Histogram                          (HINDU)
3)  Clustering via Cluster Distances                  (ISOCLASS)
4)  Performs a clustering classification              (KMEANS)
5)  Apply polygonal mask to an image                  (MASK)
6)  Combine level 1 and level 2 classifications      (SPECCOMB)
7)  Stratifies a multi-spectral image                 (SPECSTRT)




Enter:  selection number, HELP, BACK, TOP, MENU, COMMAND, or LOGOFF.
```

```
Tutor: proc "ISOCLASS", library "LAS $APPL"                    Pg 1+

Performs an unsupervised classification using an ISODATA algorithm

  parm          description                              value
  ----          -----------                              -----

IN              (Required)
                Input image.


OUT             Output classified image.




Enter: parm=value,HELP,PAGE,QUALIFY,SHOW,RUN,EXIT,SAVE,RESTORE; RETURN to page
```

```
Tutor: proc "ISOCLASS", library "LAS $APPL"                    Pg 3+

Performs an unsupervised classification using an ISODATA algorithm

  parm          description                              value
  ----          -----------                              -----

SFOUT           Output statistics file

MAXIT           Maximum number of                          2
                iterations

DLMIN           Threshold for combining                  3.2
                clusters

Enter: parm=value,HELP,PAGE,QUALIFY,SHOW,RUN,EXIT,SAVE,RESTORE; RETURN to page
```

```
Help:  parameter "MAXIT", proc "ISOCLASS"                      Pg 1+

MAXIT specifies the maximum number of clustering iterations.

With each iteration, ISOCLASS passes through the input data and assigns
pixels to clusters using either a split or combine operation.  Program
execution will terminate once MAXIT iterations have occurred, or the user
may interrupt processing by using the 'VIEW' parameter.  See 'VIEW'.

Enter EXIT or PAGE n (or press RETURN for next page)
```

# FUNCTIONAL CAPABILITIES--DISPLAY

- Interim Solution--Bridge Between TAE and IIS CI
- Permanent Solution--Available in December 1986
  Display Management Subsystem (DMS)
  - IIS
  - DeAnza
  - Raster Technologies
  - Adage

# INDEPENDENT AUDIT--APPROACH

- Module Test = A total of 224 modules
- Macro-Module (Scenario) Evaluation

| Number | Macro-module Descriptions |
|---|---|
| 13 | Data transfer |
| 7 | Preprocessing |
| 10 | Geographic image registration |
| 9 | Data transformation |
| 7 | Creation of raster images from digitized map data |
| 13 | Supervised classification |
| 8 | Unsupervised classification |
| 16 | Spatial and frequency feature extraction |
| 2 | SAS interface testing |
| 24 | Display subsystem |
| 2 | Catalog manager and tape library |

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# SYSTEM PERFORMANCE

- Speed = CPU and I/O
- Accuracy = Validity of Results

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# CLASSIFICATION OF HUNTSVILLE, ALABAMA USING THE TASSELED CAP TRANSFORMATION

| LAS FUNCTION | |
|---|---|
| CCTTIPSP<br>COPY<br>FACTOR<br>SCALE | PREPROCESSING |
| TIESELECT<br>REGISTER<br>COPY | REGISTRATION |
| ISOCLASS<br>COLOR<br>RENUMBER<br>MASKSTAT<br>BAYES<br>CONTABLE | CLASSIFICATION |
| COLOR<br>LUTSAV<br>GROUP<br>CFIRE | DISPLAY |

## DESIRED ENHANCEMENTS

- Display
- Reformat Session History
- Catalog Manager
- AP Improvement
- AMS/MOSS Interface With LAS
- UNIX Conversion
- Porting to Microcomputer

## CONFIGURATION CONTROL BOARD (CCB)--JUNE 1985

**Board Members:**

| | |
|---|---|
| **Lyn Oleson:** | **EROS Data Center/Computer Services Branch** |
| **Bruce Quirk:** | **EROS Data Center/Applications Branch** |
| **Stephen Wharton:** | **GSFC/Laboratory for Terrestrial Physics** |
| **Yun-Chi Lu:** | **GSFC/Space Data and Computing Division** |

## DOCUMENTATION

- Applications Programmer's Guide
- LAS User's Manual (on-line and off-line)
- LAS Installation Guide

## DISSEMINATION OF LAS

- Documentation/Information Through User Support Office [GSFC/(301) 286-6034]
- Software Through COSMIC, University of Georgia, Athens, GA 30601